



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/676,269	09/28/2000	Jian J. Chen	LAM1P151	6726
22434	7590	11/14/2003	EXAMINER	
BEYER WEAVER & THOMAS LLP P.O. BOX 778 BERKELEY, CA 94704-0778			ALEJANDRO MULERO, LUZ L	
			ART UNIT	PAPER NUMBER
			1763	

DATE MAILED: 11/14/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	09/676,269	CHEN ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Luz L. Alejandro	1763	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 22 September 2003.
- 2a) ☒ This action is **FINAL**.                      2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-10,12,13,15-24 and 26-31 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-10,12,13,15-24 and 26-31 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
     Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
     Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. §§ 119 and 120**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.
- 13) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application) since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.
- a) ☐ The translation of the foreign language provisional application has been received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121 since a specific reference was included in the first sentence of the specification or in an Application Data Sheet. 37 CFR 1.78.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)                             | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s). _____  |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)         | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ | 6) <input type="checkbox"/> Other: _____                                    |

## DETAILED ACTION

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 1, 4-7, 9, and 27-31 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757.

Imafuku et al. shows the invention substantially as claimed including a plasma confining assembly for minimizing unwanted plasma formations in regions outside of a process region in a plasma chamber 2, comprising: a first confining element 27 in a form of a ring and positioned proximate the periphery of the process region and in an upper portion of the process chamber, and including an exposed conductive surface that is electrically grounded; and a second confining element 47 in a form of a ring and positioned proximate the periphery of the process region, the second confining element being spaced apart from the first confining element and in a lower portion of the process chamber such that one of the confining elements is disposed in an upper portion of the process chamber and the other confining element is disposed in a lower portion of the process chamber, wherein the first and second confining elements substantially reduce

the effects of plasma forming components that pass therebetween (see fig. 11 and its description).

Imafuku et al. further discloses that the second confining element can be conductive and grounded (see col. 11-lines 58-67), but fails to disclose an exposed insulating surface which is configured to at least partially cover the conductive part of the second confining element. Aruga et al. discloses covering a conductive surface with an insulating ceramic in order to protect the conductive surface from attack by the plasma (see col. 5-lines 25-30). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al. so as to cover the second confining element with an insulator as suggested by Aruga et al. because in such a way the conductive portion of the second confining element would not be attacked by the plasma.

With respect to claim 4, the plasma forming components in both Imafuku et al. and Aruga et al. are charged particles or electric fields.

Concerning claims 5-6, the apparatus of Imafuku et al. modified by Aruga et al. would contain the claimed first and second confining element structure arrangement and therefore the apparatus of Imafuku et al. modified by Aruga et al. would have a first and second confining element arranged to direct charged particles to the exposed conductive surface and sink charged particles therethrough to ground so as to reduce the density of charged particles in regions outside the process region, and the elements would also be arranged to attract electric fields to the grounded conductive surface and the grounded conductive portion, respectively, so as to reduce the electric field strength

in regions outside of the processing region. Furthermore, the second confining element is spaced from the first confining element so as to form an open area therebetween that permits by-product gases to pass therethrough from the process region to the regions outside of the process region while substantially preventing charged particles or electric fields from passing therethrough from the process region to the regions outside of the process region.

With respect to claim 9, note that rearrangement of parts of an apparatus does not render the apparatus patentable when the rearrangement of parts of the apparatus would not have modified the operation of the apparatus (see *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950)).

Regarding claims 27-29, note that the combination of Imafuku et al. with Aruga et al. will result in: 1) the exposed conductive surface facing the exposed insulating surface such that the exposed insulating surface is disposed between the exposed conductive surface and the non exposed conductive core, 2) wherein the insulating surface prevents electrons or negative ions from becoming trapped between the exposed conductive surface and the non exposed conductive core, and 3) wherein the exposed conductive surface that is grounded and the exposed insulating surface that covers a non-exposed conductive core that is electrically grounded cooperate to form a DC potential therebetween when an RF voltage is supplied to the process chamber, the DC potential guiding charged particles to the exposed conductive surface that is grounded, the exposed conductive surface that is grounded sinking the guided charged

particles therethrough to ground so as to reduce the density of charged particles in regions outside of the process region.

Regarding claim 30, note that the combination of Imafuku et al. with Aruga et al. will also result in an insulating surface preventing charged particles from sinking into the non-exposed conductive core that is electrically grounded, the non-exposed conductive core that is electrically grounded being configured to attract electric fields so as to reduce the electrical field strength in regions outside of the process region.

Claims 12-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 as applied to claims 1, 4-7, 9, and 27-31 above, and further in view of Takaki et al., U.S. Patent 6,279,504 B1 or Nawata et al., U.S. Patent 6,444,087 B2.

Imafuku et al. and Aruga et al. are applied as above but do not expressly disclose wherein the non-exposed conductive core is formed from aluminum and the exposed insulating surface is formed from anodized aluminum.

First, the examiner respectfully contends that aluminum is a well known conductive material and anodized aluminum is a well known insulating material, and both materials are used in a plasma environment. Furthermore, Nawata et al. and Takaki et al. both disclose an aluminum conductor covered by an anodized aluminum insulator (see col. 1-lines 49-54 of Nawata et al. and fig. 10, col. 17-lines 8-28 of Takaki et al.). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al.

modified by Aruga et al. so as to form the second confining element of an aluminum material with an alumina material thereover because both Takaki et al. and Nawata et al. show these materials to be suitable for use in a plasma apparatus.

Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 as applied to claims 1, 4-7, 9, and 27-31 above, and further in view of Lenz et al., U.S. Patent 5,534,751.

Both Imafuku et al. and Aruga et al. are applied as above but fail to expressly disclose a third confining element formed from an insulating material and disposed between the first confining element and the second confining element, and proximate the periphery of the process region, the third confining element being arranged to physically contain the plasma inside the process region, and to substantially reduce the effects of plasma forming components that pass between the first confining element and the second confining element. Lenz et al. discloses a ring assembly 30 used for plasma confinement and including a stack of circular rings that contain an insulating material of, for example, quartz (see figs. 1-2 and col. 6-lines 16-65). Additionally, note that the ring assembly 30 is configured to physically confine the plasma within the process region while permitting the process gases to pass through passages 31 (see fig. 1 and col. 6-lines 30-35). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et

al. modified by Aruga et al. so as to contain the plasma confinement element of Lenz et al. in order to confine the plasma in the process region.

Claims 2-3 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 as applied to claims 1, 4-7, 9, and 27-31 above, and further in view of Lenz, U.S. Patent 5,998,932 or Lenz, WO 00/00992.

Both Imafuku et al. and Aruga et al. are applied as above but fail to expressly disclose a third confining element formed from an insulating material and disposed between the first confining element and the second confining element, and proximate the periphery of the process region, the third confining element being arranged to physically contain the plasma inside the process region, and to substantially reduce the effects of plasma forming components that pass between the first confining element and the second confining element. Lenz discloses confinement element used for plasma confinement and including circular rings 102a, 102b that contain an insulating material (see figs. 1-4 and their description, especially col. 1-lines 48-50 of Lenz, U.S. 5,998,932; and paragraph bridging pages 1 and 2 of Lenz WO 00/00992). Additionally, note that the confinement element is configured to physically confine the plasma within the process region while permitting the process gases to pass through passages therebetween (see figs. 1-4 of both Lenz U.S. 5,998,932 and Lenz WO 00/00992). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al. modified by

Aruga et al. so as to contain the plasma confinement element of Lenz et al. in order to confine the plasma in the process region to improve process control and to ensure repeatability.

Claims 8, 10, 16-24, and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 as applied to claims 1, 4-7, 9, and 27-31 above, and further in view of Hasegawa et al., U.S. Patent 5,271,788.

Imafuku et al. and Aruga et al. are applied as above but fail to expressly disclose wherein the second confining element is a ring that surrounds a lower electrode. Hasegawa et al. discloses a confining element 16,32 that surrounds a lower electrode 12 (see fig. 3 and col. 4-line 43 to col. 5-line 7). In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al. modified by Aruga et al. so as to form the second confining element so as to surround the lower electrode because in such a way the electrode would be protected from the plasma and therefore, the apparatus of Imafuku et al. modified by Aruga et al. would be optimized.

Regarding claims 8, 10, 17, and 22, note that the first confining element in Imafuku et al. is a ring that surrounds an upper electrode. Furthermore, note that rearrangement of parts of an apparatus does not render the apparatus patentable when the rearrangement of parts of the apparatus would not have modified the operation of the apparatus (see *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950)).

Concerning claims 16 and 21, note that rearrangement of parts has been held to have been obvious (see *In re Japikse*, 181 F.2d 1019, 86 USPQ 70 (CCPA 1950)). Furthermore, the configuration of the claimed exposed insulating surface, and of the first and second rings, is a matter of choice which a person of ordinary skill in the art would have found obvious absent persuasive evidence that the particular configuration of the exposed insulating surface, and of the first and second rings, is significant (*In re Dailey*, 357 F.2d 669, 149 USPQ 47 (CCPA 1966)).

With respect to claim 18, note that the first ring of Imafuku et al. includes an inner ring and an outer ring wherein the inner ring is formed from a dielectric medium and is configured to be disposed between the first electrode and the outer ring, and wherein the outer ring includes the conductive member of the first ring (see fig. 11 especially the dielectric member between ring 27 and electrode 21).

Concerning claim 19, note that Imafuku et al. in fig. 23 shows an insulating member 5a configured to be disposed between the second electrode and the outer ring. In view of this disclosure, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of fig. 11 of Imafuku et al. as to further comprise an insulating member disposed between the second electrode and the outer ring as shown in the embodiment of fig. 23 of Imafuku et al. in order to provide appropriate electrical separation between the conductive elements.

With respect to claim 24, note that the first and second confining elements are located between the process region and the exhaust port (see fig. 11 of Imafuku et al.). Furthermore, regarding claim 26, note that the exposed conductive member of the first

confining element and the exposed insulating portion of the second confining element each include surfaces that are substantially parallel to one another and that are perpendicular to the boundary between the process region where a plasma is ignited and sustained for processing a workpiece and the regions outside of the process region where the plasma is not desired (see fig. 11).

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 and further in view of Hasegawa et al., U.S. Patent 5,271,788 as applied to claims 8, 10, 16-24, and 26 above, and further in view of Lenz et al., U.S. Patent 5,534,751.

Imafuku et al., Aruga et al., and Hasegawa et al. are applied as above but fail to expressly disclose a third confining element formed from an insulating material and disposed between the first confining element and the second confining element, and proximate the periphery of the process region, the third confining element being arranged to physically contain the plasma inside the process region, and to substantially reduce the effects of plasma forming components that pass between the first confining element and the second confining element. Lenz et al. discloses a ring assembly 30 used for plasma confinement and including a stack of circular rings that contain an insulating material of, for example, quartz (see figs. 1-2 and col. 6-lines 16-65). Additionally, note that the ring assembly 30 is configured to physically confine the plasma within the process region while permitting the process gases to pass through passages 31 (see fig. 1 and col. 6-lines 30-35). In view of this disclosure, it would have

been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al. modified by Aruga et al. and Hasegawa et al. so as to contain the plasma confinement element of Lenz et al. in order to confine the plasma in the process region.

Claim 15 is rejected under 35 U.S.C. 103(a) as being unpatentable over Imafuku et al., U.S. Patent 6,074,518 in view of Aruga et al., U.S. Patent 5,456,757 and further in view of Hasegawa et al., U.S. Patent 5,271,788 as applied to claims 8, 10, 16-24, and 26 above, and further in view of Lenz, U.S. Patent 5,998,932 or Lenz, WO 00/00992.

Imafuku et al., Aruga et al., and Hasegawa et al. are applied as above but fail to expressly disclose a third confining element formed from an insulating material and disposed between the first confining element and the second confining element, and proximate the periphery of the process region, the third confining element being arranged to physically contain the plasma inside the process region, and to substantially reduce the effects of plasma forming components that pass between the first confining element and the second confining element. Lenz discloses confinement element used for plasma confinement and including circular rings 102a, 102b that contain an insulating material (see figs. 1-4 and their description, especially col. 1-lines 48-50 of Lenz, U.S. 5,998,932; and paragraph bridging pages 1 and 2 of Lenz WO 00/00992). Additionally, note that the confinement element is configured to physically confine the plasma within the process region while permitting the process gases to pass through passages therebetween (see figs. 1-4 of both Lenz U.S. 5,998,932 and Lenz WO

00/00992). In view of these disclosures, it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the apparatus of Imafuku et al. modified by Aruga et al. and Hasegawa et al. so as to contain the plasma confinement element of Lenz et al. in order to confine the plasma in the process region to improve process control and to ensure repeatability.

### ***Response to Arguments***

Applicant's arguments filed 9/22/03 have been fully considered but they are not persuasive.

With respect to the rejection under 35 USC 103(a) of Imafuku et al. and Aruga et al., the examiner respectfully contends that all the limitations are taught and the motivation to combine references is proper. Concerning applicant's statement that Imafuku et al. fails to show a non-exposed ground electrode, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Furthermore, Aruga et al. provides ample motivation to cover a conductor with an insulator in a plasma environment. Aruga et al. is being used for the broad teaching of covering a conductor with an insulator for protection in a plasma environment, not any other specific apparatus limitations such as showing a confining element.

In response to applicant's argument that Imafuku and Aruga et al. are nonanalogous art, it has been held that a prior art reference must either be in the field of

applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the applicant was concerned, in order to be relied upon as a basis for rejection of the claimed invention. See *In re Oetiker*, 977 F.2d 1443, 24 USPQ2d 1443 (Fed. Cir. 1992). In this case, both Imafuku and Aruga et al. as well as the instant application are directed to a plasma apparatus.

Furthermore concerning applicant's statement that the electrodes in Imafuku do not need an insulating layer for plasma protection, the examiner respectfully submits that there will still be a measurable quantity of plasma near the electrodes of Imafuku and an insulating layer provided on the electrodes will ensure adequate protection for the electrodes from the plasma. Regarding applicant's statement that it would not make sense for just one of the ground electrodes to be protected, the second confining element 47 is closer to the substrate so it would be more important for this confining element to be protected because of possible contamination from by-products emanating from the substrate surface.

In response to applicant's argument that the examiner's conclusion of obviousness is based upon improper hindsight reasoning, it must be recognized that any judgment on obviousness is in a sense necessarily a reconstruction based upon hindsight reasoning. But so long as it takes into account only knowledge which was within the level of ordinary skill at the time the claimed invention was made, and does not include knowledge gleaned only from the applicant's disclosure, such a reconstruction is proper. See *In re McLaughlin*, 443 F.2d 1392, 170 USPQ 209 (CCPA 1971).

***Conclusion***

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

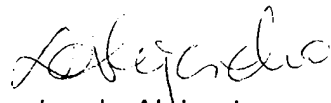
Any inquiry concerning this communication or earlier communications from the examiner should be directed to Luz L. Alejandro whose telephone number is 703-305-4545. The examiner can normally be reached on Monday to Thursday from 7:30 to 6:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Gregory L. Mills can be reached on 703-308-1633. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Application/Control Number: 09/676,269  
Art Unit: 1763

Page 15

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.



Luz L. Alejandro  
Primary Examiner  
Art Unit 1763

November 11, 2003